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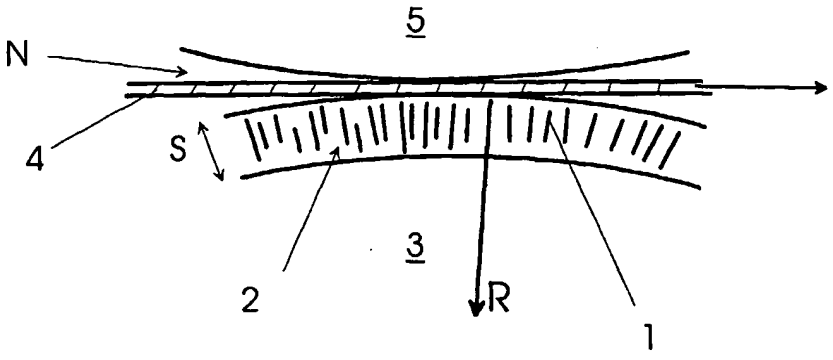
(54) Title: A POLYMER COATING AND A METHOD FOR ADJUSTING THE PROPERTIES OF THE POLYMER COATING OF A ROLL OR A BELT



(57) Abstract: The invention relates to a method for adjusting the properties of the polymer coating (2) of a roll or a belt (3), whereby the roll or the belt is used for calendering a fibrous web (4) in a roll nip (N), which is formed between the roll or the belt and its backing roll (5), whereby the roll or the belt has a polymer coating comprising fibrous material (1). In the method, the thermal elongation coefficient and/or thermal conductivity of the polymer coating (2) are adjusted by directing the fibre direction of the fibrous material (1).

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A PLOYMER COATING AND A METHOD FOR ADJUSTING THE PROPERTIES OF THE POLYMER COATING OF A ROLL OR A BELT

The invention relates to the method according to the introduction of claim 1, for example, for adjusting the properties of the polymer coating of a roll or a belt.

The invention also relates to a polymer coating of a roll or a belt according to claim 5, for example.

When a fibrous web is calendered in a roll nip, which is formed in the nip between a polymer-coated roll or belt and the backing roll thereof, breaks in the track of the fibrous web or a foreign object drifting through the roll nip easily cause damage in the polymer coating. Generally, damage in the coating material of a polymer-coated roll or belt is the result of the foreign object, such as a piece of tape, a spot of paste, etc., adhered to the fibrous track or the surface of the roll causes temporary overload of the roll nip. The so-called packaging of the roll caused by a break in the fibrous web may also cause momentary overloading, i.e., a pressure peak in the roll nip. Overloading can also be caused by a transverse error in the profile of the paper web, causing a continuous pressure peak in the roll nip.

The purpose of the invention is to eliminate the disadvantages of prior art. The main object of the invention is to provide an arrangement, which effectively prevents damage to the polymer coating of the roll or the belt, which are caused by overloading the polymer coating, when the fibrous web is calendered in the roll nip.

The state of overload can cause immediate damage to the polymer coating, or the momentary overload of the roll nip can cause heat production in the polymer coating. Heat production causes a local pressure increase in the polymer coating because of thermal expansion, which further increases local deformation. This causes further local heat production in the polymer coating. The state of overload thus easily causes a self-feeding local deformation in the polymer coating, easily resulting in damage to the polymer coating.

The invention is based on the basic idea that the thermal elongation coefficient and/or the thermal conductivity of the polymer coating of the roll or the belt in the radial direction of the roll is arranged so that the polymer coating in the radial direction of the roll expands much less than normally. This is provided by the fibre direction of the fibrous material of the roll coating being at least partially in the radial direction of the roll. As the thermal conductivity of the fibres in the radial direction of the roll is good and their thermal elongation coefficient is small or even negative, the increase in local heat production results in a minor expansion of the coating

only, or even in local reduction in the radial direction of the roll, effectively preventing damage to the polymer coating.

As the thermal elongation coefficient of the polymer coating in the radial direction of the roll is minor, no self-feeding local deformation described above is produced in the polymer coating used in the arrangement according to the invention. By further arranging the thermal conductivity of the polymer coating in the radial direction of the roll high, heat increase in the polymer coating is further reduced and damage is effectively prevented.

The invention relates to the method according to claim 1, for example, for adjusting the properties of the polymer coating of the roll or the belt.

The invention also relates to the polymer coating according to claim 5, for example.

In the method according to the invention, the properties of the polymer coating of the roll or the belt are adjusted, when the fibrous web is calendered in the roll nip formed between the roll or the belt and its backing roll, whereby the roll or the belt has a polymer coating comprising fibrous material, and the thermal elongation coefficient and/or thermal conductivity are adjusted by directing the fibre direction of the fibrous material.

The radial direction of the roll herein refers to the direction of the roll radius at a certain point on the roll surface. If we are talking about a belt, the radial direction of the roll refers to the perpendicular direction of the belt.

The thermal elongation coefficient of the polymer coating material used in the arrangement is preferably minor in the radial direction of the roll and/or the thermal conductivity of the polymer coating material in the radial direction of the roll is high.

The polymer coating mainly consists of fibrous material and resin. The fibrous material is preferably carbon fibre or aramid fibre. Carbon fibre is an extremely good heat conductor, and its thermal expansion coefficient in the longitudinal direction of the fibre is negative. Thus, one advantage of polymer coating manufactured from carbon fibre reinforced resin is both good thermal conductivity and a negative thermal expansion coefficient in the longitudinal direction of the fibre.

In a preferred embodiment of the invention, the thermal elongation coefficient of the fibrous material is arranged to be zero or negative in the radial direction of the roll by directing the longitudinal direction of the fibrous material fibres so that it mainly diverges by 45 degrees at a maximum from the radial direction of the roll. When the direction of the fibres from the radial direction of the roll is 45 degrees at

a maximum, this provides the advantage that local heating of the polymer coating causes a local reduction in the polymer coating or the coating to remain the same.

EP patent publication 1 001 081 discloses a supercalendering method of fibrous web, wherein the selection of the roll coating material is intended to provide the fibrous web with desired transparency properties. Similar fibre structures are used in the roll coating as in the invention, but the direction of the fibres is the same as that of the roll surface. Instead, the purpose of the present patent application is to prevent damage to the roll coating by adjusting the thermal elongation coefficient and/or thermal conductivity of the polymer coating. In that case, the fibre direction of the roll coating material fibres is selected so that it is at least partially in the radial direction of the roll.

The polymer coating used in the arrangement according to the invention provides the following additional advantages, among others:

Normally, the elasticity modulus of the polymer coating is adjusted by means of the ratio of the filler of the polymer coating to the resin. The elasticity modulus of the carbon fibre present in the polymer coating according to the invention is very high, whereby the elasticity modulus or the resilience of the polymer coating can be adjusted within a very large range by also changing the ratio of the resin to the carbon fibre, and/or by varying the quality of the resin. In that case, the polymer coating according to the invention can be used, when very different paper and cardboard qualities are calendered.

The Tg of carbon fibre reinforced laminating resins is more than 150°C or even over 200°C, whereby the polymer coatings made of these laminates endure very high calendering temperatures without suffering from permanent deformation.

It is possible to coat the roll (or the belt) with laminating resins by means of various methods, among others, by spreading, reeling, injecting or sizing a thin laminated tube on the surface of the roll, etc. The roll can be, among others, a polymer coated steel roll or paper roll. The coating can also be manufactured by laminating thin laminated discs on top of the roll axis, the fibre direction thereof being as desired. Thus, it is possible to manufacture polymer coatings made of laminated carbon fibre by means of various alternative methods, making it possible to use the polymer coating as a coating material of rolls and belts intended for various targets of calendering.

It is easy to renew the outer layer of carbon fibre or aramid fibre reinforced polymer coatings, for example, by spreading and hardening a new surface layer.

In the following, the invention is described in detail with reference to the appended drawing.

Fig. 1 shows a schematic cross-sectional view of part of the roll coating.

As viewed from the end of a roll nip, Fig. 1 shows the roll nip between two rolls. The roll nip N is formed between a heated hard thermo roll 5 and a polymer coated roll 3 opposite the thermo roll. A fibrous web 4 travels in the roll nip N between the rolls, the surface of the web being calendered, when the web travels through the roll nip between the rolls from left to right. A polymer coating 2 on top of the roll 3, the thickness of which is s, consists of epoxy resin, carbon fibre, and a filling agent. The fibre direction of the carbon fibre 2 is mainly the same as the direction of the radius R of the roll. If a foreign object enters the roll nip along with the fibrous web, for example, it causes local heating of the polymer coating. Local heating of the polymer coating causes a reduction in the polymer coating in its perpendicular direction, i.e., the radial direction R of the roll, which in turn results in cooling of the fibrous web.

The behaviour of a roll coating coated with the polymer coating according to the invention is described above, when it heats locally. If the polymer coating is on top of the belt of a belt calender, the fibre direction of fibres 1 is mainly arranged in the perpendicular direction s of the belt.

Claims

1. A method for adjusting the properties of the polymer coating (2) of a roll or a belt (3), whereby the roll or the belt is used for calendering a fibrous web (4) in a roll nip (N), which is formed between the roll or the belt and its backing roll (5), whereby the roll or the belt has a polymer coating comprising fibrous material (1), **characterized** in that the thermal elongation coefficient and/or thermal conductivity of the polymer coating (2) are adjusted by directing the fibre direction of the fibrous material (1).

2. A method according to claim 1, **characterized** in that in the method, the elasticity of the polymer coating (2) is further adjusted by changing the proportion of the fibrous material and the resin contained by the polymer coating with respect to one another.

3. A method according to claim 1 or 2, **characterized** in that the fibre direction of the fibrous material (1) is adjusted so that the locally increased heat production of the polymer coating (2) results in a local reduction in the polymer coating at least in the radial direction (R) of the roll.

4. A method according to any of the preceding claims, **characterized** in that the roll (3) is a paper roll.

5. A polymer coating (2) of a roll or a belt, wherein the roll or the belt is used for calendering a fibrous web (4) in a roll nip (N), which is formed between the roll or the belt and its backing roll (5), whereby the polymer coating contains fibrous material (1), **characterized** in that the fibre direction of the fibrous material of the polymer coating is at least partially in the radial direction (R) of the roll.

6. A polymer coating (2) according to claim 5, **characterized** in that the fibre direction of the fibrous material (1) diverges by 45 degrees from the radial direction (R) of the roll at a maximum.

7. A polymer coating (2) according to claim 5 or 6, **characterized** in that the fibrous material (1) is carbon fibre.

8. A polymer coating (2) according to claim 5 or 6, **characterized** in that the fibrous material (1) is aramid fibre.

9. A polymer coating (2) according to any of claims 5 to 8, **characterized** in that the polymer coating is on top of the paper roll.

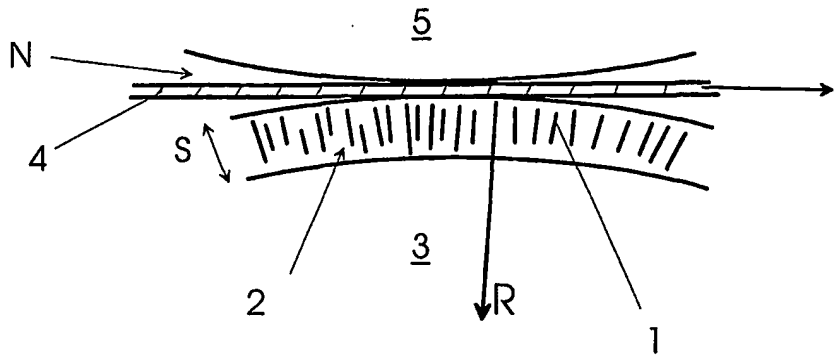

Fig 1